

## REMARKS

Claims 1-17 and new claims 19-22 remain herein for consideration. Reconsideration in view of this amendment is requested.

By this amendment, Claims 1, 6 and 9 have been amended and new claims 19-22 added.

### Rejections Under §112, second paragraph

The Examiner has rejected Claim 1 under 35 U.S.C. §112, second paragraph stating that the term “subminiature” is “vague”. This rejection is traversed because the subminiature through holes are clearly defined as in a range of approximately 0.002-.006 inches at page 6, lines 5-7, page 15, lines 13-15. The advantages of these subminiature holes are also pointed out at page 6, lines 7-14, and at page 15, line 15-17. Further advantages of the miniature and subminiature construction is discussed at page 11, line 11 through page 12, line 9. Claim 1 has been amended to positively recite this range for the subminiature through hole.

Claim 6 has been amended to clarify the symmetric relationship of the two cells to the flow channel.

Claim 9 has been amended to clarify that the materials are in fact a composition of the three materials.

### Rejections Under §103

The Examiner has rejected Claims 1-3, 6- 13 under 35 USC §103 as being unpatentable over Betts in view of Pace, et al. '978, Pace '410, Knudson et al., Brown et al. or Madou et al.

Applicants traverse the Examiner's rejection for the reason there is no teaching or suggestion in the references for combining them, and even if combined they would not provide the claimed invention. First of all, neither one of Betts nor any of the other references disclose or suggest "subminiature through holes" as claimed. Moreover, none of the secondary references suggest nor motivate one skilled in the art to provide a thru-hole *directly under* the sensors of Betts.

The applicants' invention is directed to an improvement over the Betts type sensor and particularly to a structure to provide a sensor which remains accurate over a relatively long period of exposure to electrolytes and blood samples, uses a very small sample size, detects the concentration of a number of different electrolytes and the partial pressure of a number of blood gasses all in a single analysis, and in which a blood sample may be heated very rapidly to a known stable temperature. To this end applicants' invention is defined by "a plurality of sensors deposited on a first side of the substrate; a plurality of electrical conductors deposited on a second side of the substrate; a plurality of subminiature thru-holes having a diameter in the range of about 0.002-.006 inches filled with electrically conductive material, each thru-hole disposed directly under a corresponding one of the sensors for coupling one of the sensors with one of the electrical conductors", as defined by claim 1 and with slightly different language in claim 19, which neither Betts nor any suggested combination of Betts and the other references disclose.

In contrast, Betts is not concerned with the applicants' problem or their solution. He discloses that a patterned metallic layer 113 has metallic external leads 146-160 on the other side of the substrate 111, as stated at cl. 19, line 53-60. Moreover, Betts neither teaches nor suggests a subminiature thru-hole disposed directly under a sensor, as recited in Claim 1, more particularly he does not teach or suggest a subminiature through hole having the dimensional

range of 0.002 - .006 inches. Betts has no need for the claimed construction and would not obviously benefit from it.

Pace '978 does not disclose through holes in a substrate and does not disclose through holes directly below a sensor. He discloses an arrangement like Betts with conductors 2 on the same side of the substrate 1 as sensors 5. The conductors 2 on the surface of the substrate 1 are protected with a dielectric layer 3 placed over the conductor to isolate the conductor and provide a well for the sensors. He does not disclose through holes.

Pace '410 does not disclose subminiature through holes in a substrate and does not disclose a flow channel between an inlet and an outlet to allow analyte to pass through a housing over sensors. He discloses multiple sample wells with multiple sensors and multiple layers 51-54 making up the electrodes inside the wells and in through holes. His through holes are mere extensions of the well by necessity. Nothing in this reference would motivate one to combine it with Betts to come up with the claimed invention.

Knudson et al. discloses a special construction for an ion effective electrode having a dome shape surrounded by a moat. He does not disclose subminiature through holes in a substrate and does not disclose a flow channel between an inlet and an outlet to allow analyte to pass through a housing over sensors. Nothing in this reference would motivate one to combine it with Betts to come up with the claimed invention.

Brown discloses a construction like Betts and does not disclose subminiature through holes in a substrate and does not disclose a flow channel between an inlet and an outlet to allow analyte to pass through a housing over sensors. He discloses a solid state electrode fabricated using a screen printing system. A substrate 21 has a layer of silicon dioxide 22 on which an aluminum

electrode 23 is deposited and over which a layer of silicon nitride 25 is arranged. There is no through hole through the substrate. A hole in a protective layer does not suggest a through hole from a sensor on one side of a substrate to a conductor on the other side of the substrate. Furthermore, there is no suggestion or motivation to provided in any of the references cited by the Examiner to provide such a subminiature thru-hole *directly under* the sensor.

Madou et al. is similar to Pace '410, and does not disclose subminiature through holes in a substrate and does not disclose a flow channel between an inlet and an outlet to allow analyte to pass through a housing over sensors. He discloses multiple sample wells which extend more that half way through the substrate to keep the distance from the back of the well to a 10-40  $\mu\text{m}$  (.0005-.0015 in.). His through holes are mere extensions of the well by necessity as the only place to put the connection for the electrodes within his parameters. Nothing in this reference would motivate one to combine it with Betts to come up with the claimed invention.

Claims 4 and 5 stand rejected under 35 U.S.C. §103 as being unpatentable over Betts in view of Pace, et al. '978, Pace '410, Knudson et al., Brown et al. or Madou et al. and Grubb. Applicants respectfully traverse the Examiner's rejection for the reasons as pointed out above with respect to claims 1-3, 6-13. None of the references cited teach or suggest a subminiature thru-hole *directly under* the sensors. Furthermore, there is no suggestion or motivation in any of the references to combine them with Betts to provide a subminiature thru-hole *directly under* the sensor. Moreover, the elongated tubular electrode half cell of Grubb does not teach or suggest modifying the sensors of the Betts combination to provide the claimed invention.

Claims 14 and 15 stand rejected under 35 U.S.C. §103 as being unpatentable over Betts in view of Pace, et al. '978, Pace '410, Knudson et al., Brown et al. or Madou et al. and Buzza. Applicants respectfully traverse the Examiner's rejection for the reasons as pointed out above with respect to claims 1-3, 6-13. None of the references cited teach or suggest a subminiature thru-hole *directly under* the sensors as pointed out above. Furthermore, there is no suggestion or motivation in any of the references to combine them with Betts to provide a subminiature thru-hole *directly under* the sensor.

Contrary to the Examiner, Buzza does not teach a flow channel having a plurality of sensors including an oxygen sensor and when the flow channel has a dome which increases the volume directly about the oxygen sensor. The dome at the end of a cylinder in Buzza doesn't suggest the claimed combination or modification. Moreover, there is no teaching or suggestion in any of the references for combining Buzza with them and modifying the passage of the Betts combination to provide the claimed invention including the dome over certain sensors.

Claims 16 and 17 stand rejected under 35 U.S.C. §103 as being unpatentable over Betts in view of Pace, et al. '978, Pace '410, Knudson et al., Brown et al. or Madou et al. and Buzza and Kuhn et al. Applicants respectfully traverse the Examiner's rejection for the reasons as pointed out above with respect to claims 1-3, 6-13, 14 and 15. None of the references cited teach or suggest a subminiature thru-hole *directly under* the sensors. Furthermore, there is no suggestion or motivation in any of the references to combine them with Betts to provide a subminiature thru-hole *directly under* the sensor. Moreover, there is no teaching or suggestion in any of the references for combining Buzza with them and modifying the passage of the Betts combination to provide the claimed invention including the dome over certain sensors.

Additionally, there is no teaching or suggestion in any of the references for combining Kuhn et al. with them and modifying the passage of the Betts combination to provide the claimed combination including the dome over certain sensors and the further feature of a hematocrit sensor in the combination. The Examiner is treating applicant's claims as a catalog of elements and picks bits and pieces from numerous separate prior art references to meet those elements.

The Examiner has repeated all of the previously rejections of all the claims substituting Pace '978 in place of Betts as the primary reference. All of the claims in the application stand rejected again on the same combination of references discussed above using Pace '978 as the primary reference. Applicants respectfully traverse the Examiner's rejection for the reasons as pointed out above with respect to all of the previous rejections of all of the claims. First of all, contrary to the Examiner, Betts does not show conductive leads on the underside of the substrate, but merely shows terminals on an end underside to which conductive leads on the sensor side of the substrate are connected.

Pace does not disclose leads on the other side of the substrate, and is even less pertinent that Betts. None of the references cited teach or suggest modifying Pace to place a subminiature thru-hole *directly under* the sensors for connection to leads on the other side of the substrate. Furthermore, there is no suggestion or motivation in any of the references to combine them with Betts to provide a subminiature thru-hole *directly under* the sensor. The Examiner has chosen bits and pieces of the claimed combination from the prior art and put them together using impermissible hindsight construction in light of applicants disclosure.

With regard to the Examiner's obviousness-type double patenting rejections, Applicants point out that each of the cited references are assigned to the same entity. Accordingly, a terminal disclaimer will, upon notice that the presented claims are in condition for allowance, be provided which disclaims any portion of the patent term which extends beyond the term of the cited reference patents.

It is believed that this application is now in condition for allowance and reconsideration is earnestly solicited.

No additional fees are due. Please charge any deficit or credit any excess to our Deposit Account No. 02-0460.

Respectfully submitted,



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